State of Louisiana
Department of Natural Resources
Coastal Restoration Division and
Coastal Engineering Division

2004 Operations, Maintenance, and Monitoring Report

for

Marsh Island Hydrologic Restoration

State Project Number TV-14
Priority Project List 6

May 2007
Iberia Parish

Prepared by:

Troy C. Barrilleaux, Biological Monitoring Section (CRD)
and
Herbert Juneau, P.E., Field Engineering Section (CED)
LDNR/Coastal Restoration and Management
Lafayette Field Office
Abdalla Hall, Room 201
635 Cajundome Blvd.
Lafayette, La 70506

Suggested Citation:

Barrilleaux, T. and H. Juneau 2007. *2004 Operations, Maintenance, and Monitoring Report for Marsh Island Hydrologic Restoration (TV-14), Louisiana Department of Natural Resources, Coastal Restoration Division, Lafayette, Louisiana.*

2004 Operations, Maintenance, and Monitoring Report
For
Marsh Island Hydrologic Restoration (TV-14)

Table of Contents

I. Introduction..1

II. Maintenance Activity..3
a. Project Feature Inspection Procedures 3
b. Inspection Results..3
c. Maintenance Recommendations 3
i. Immediate/Emergency...3
ii. Programmatic/Routine...3

III. Operation Activity 3
a. Operation Plan..3
b. Actual operations 3

IV. Monitoring Activity 4
a. Monitoring Goals 4
b. Monitoring Elements 4
c. Preliminary Monitoring Results and Discussion 11

V. Conclusions..20
a. Project Effectiveness...20
b. Recommended Improvements 20
c. Lessons Learned...20

I. Introduction

The Marsh Island Hydrologic Restoration Project is located in Iberia Parish approximately six miles south of Cypremort Point. The project area encompasses approximately 6,697 acres (2,710 ha) of wetlands on the northeast tip of Marsh Island east of Bayou Blanc (figure 1). It comprises 5,034 acres (2,037 ha) of brackish marsh and 1,663 (673 ha) acres of open water, based on the Louisiana Department of Natural Resource's GIS data for 1984. Common plant species found in the project area include *Juncus roemerianus* (needlegrass rush), *Spartina patens* (saltmeadow cordgrass), *Schoenoplectus maritimus* (cosmopolitan bulrush), *Schoenoplectus americanus* (chairmaker's bulrush), *Spartina alterniflora* (saltmarsh cordgrass), and *Vigna luteola* (hairypod cowpea).

Between 1930 and the present, the hydrology of Marsh Island has changed due to tidal influenced erosion, subsidence, and oil and gas exploration. Several oil field canals were constructed to facilitate oil and gas exploration in the project area during the 1950's. Recent deterioration and subsidence of the spoil banks deposited in the 1950's have resulted in cuts in the spoil banks that have become conduits for rapid tidal exchanges between the surrounding bays and the interior marshes. These rapid exchanges have resulted in tidal scouring and the loss of marsh vegetation through erosion and subsidence. Lake Sand and a number of interior lakes also supported a significant amount of submerged aquatic vegetation (SAV). Today these lakes are almost devoid of SAV, presumably due to the effects of increased tidal exchange and increased turbidity. Erosion has also lead to the deterioration of the northeast end of Marsh Island and the north rim of Lake Sand, leaving exposed a highly organic brackish marsh.

During the life of the 20 year project, 408 acres (168 ha) of wetlands will be protected. The project consists of the construction of 9 plugs in oil and gas canals at the northeast end of Marsh Island, the protection of the northeast shoreline of Marsh Island, and isolating Lake Sand from Vermilion Bay with a free-standing rock breakwater (figure 1). Project construction began on July 25, 2001 with the construction of approximately 4,000 linear feet of rock breakwater to protect the north shoreline on Lake Sand by contractor Tacon Company, Inc. of Bartlett, Tennessee and subcontractor Luhr Brothers, Inc. of Columbia, Illinois. A total of seven canals were plugged with rock armor while one was plugged with an earthen closure only. An additional closure, constructed of painted steel sheetpile and rock armor, was constructed at the mouth of an oil exploration canal on the eastern end of the project area. Construction of the $2.9 million project was completed on December 12, 2001.

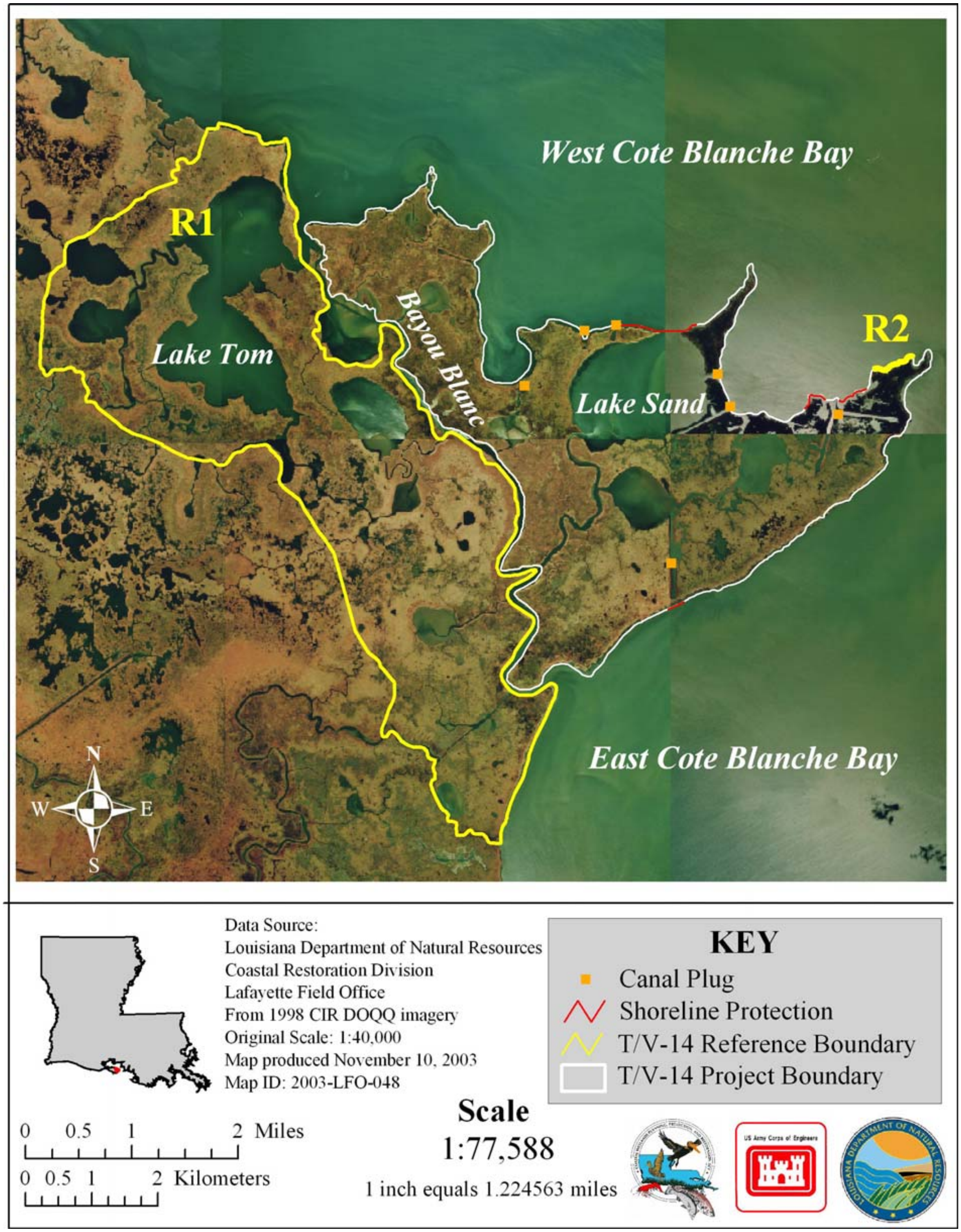

Figure 1. Marsh Island Hydrologic Restoration (TV-14) project boundary and features.

II. Maintenance Activity

a. Project Feature Inspection Procedures

The purpose of the annual inspection of the Marsh Island Hydrologic Restoration Project (TV-14) is to evaluate the constructed project features to identify any deficiencies and prepare a report detailing the condition of project features and recommended corrective actions needed. Should it be determined that corrective actions are needed, LDNR shall provide, in the report, a detailed cost estimate for engineering, design, supervision, inspection, and construction contingencies, and an assessment of the urgency of such repairs.

An inspection team comprised of two representatives of LDNR and one representative of USACE performs annual visual inspections. If damage is apparent, LDNR and USACE assigns a team to perform a detailed inspection and report on the findings. The team documents the condition of the project features and may employ a survey party to make detailed measurements

b. Inspection Results

No inspection was conducted in calendar year 2003/2004. Aucoin & Associates has begun preliminary engineering to repair damages incurred after Hurricane Lili.

c. Maintenance Recommendations

i. Immediate/ Emergency Repairs

Construction to repair the damages caused by Hurricane Lili should begin in spring 2005. These repairs consist of raising the Lake Sand Closure dike back to a functional elevation in areas as required as well as extending the wingwalls and paving the marsh around Canal Closure #5 with rock.

ii. Programmatic/ Routine Repairs

No routine repairs are required at this time.

III. Operation Activity

a. Operation Plan

This project requires no operations; therefore, no structure operations have been conducted.

b. Actual Operations

This project requires no operations; therefore, no structure operations have been conducted.

IV. Monitoring Activity

a. Monitoring Goals

The objective of the Marsh Island Hydrologic Restoration Project is to restore more natural hydrologic conditions in the project area resulting in the protection of the existing marsh.

The following goals will contribute to the evaluation of the above objective:

1. Reduce water level variability in the project area.
2. Decrease the rate of marsh loss in the project area.
3. Reduce erosion rate of the northeast shoreline of Marsh Island.
4. Increase the occurrence of submerged aquatic vegetation in Lake Sand and in shallow open water within the project area.

b. Monitoring Elements

Aerial Photography:
Near-vertical color-infrared aerial photography (1:12,000 scale) was used to measure vegetated and non-vegetated areas for the project and reference areas. The photography was obtained in 2000 prior to project construction and will be obtained in 2004, 2009, and 2016 following construction. The original photography was checked for flight accuracy, color correctness, and clarity and was subsequently archived. Aerial photography was scanned, mosaicked, and georectified by USGS/NWRC personnel according to standard operating procedures (figure 2).

Shoreline Change:
To document shoreline movement along the northeast shoreline of Marsh Island, a differential GPS (DGPS) survey of unobstructed sections of shoreline was conducted at the vegetative edge of the bank to document the position of the shoreline in 1999 (pre-construction) and 2003 (post-construction) (figures 3-4). Subsequent surveys will be conducted post-construction in 2004, 2009, and 2016. A similar survey will be conducted concurrently along a 2,000 ft (609.6 m) section of reference area 2 (R2). DGPS shoreline positions were mapped and used to compare shoreline erosion/growth rates in the project area and in R2 using GIS analysis.

Water Level:
Water level variability is monitored hourly at two continuous data recorders deployed in the project area and two continuous data recorders deployed in reference area 1 (R1) (figure 5). Staff gages adjacent to the continuous recorders were surveyed to correlate water levels to a

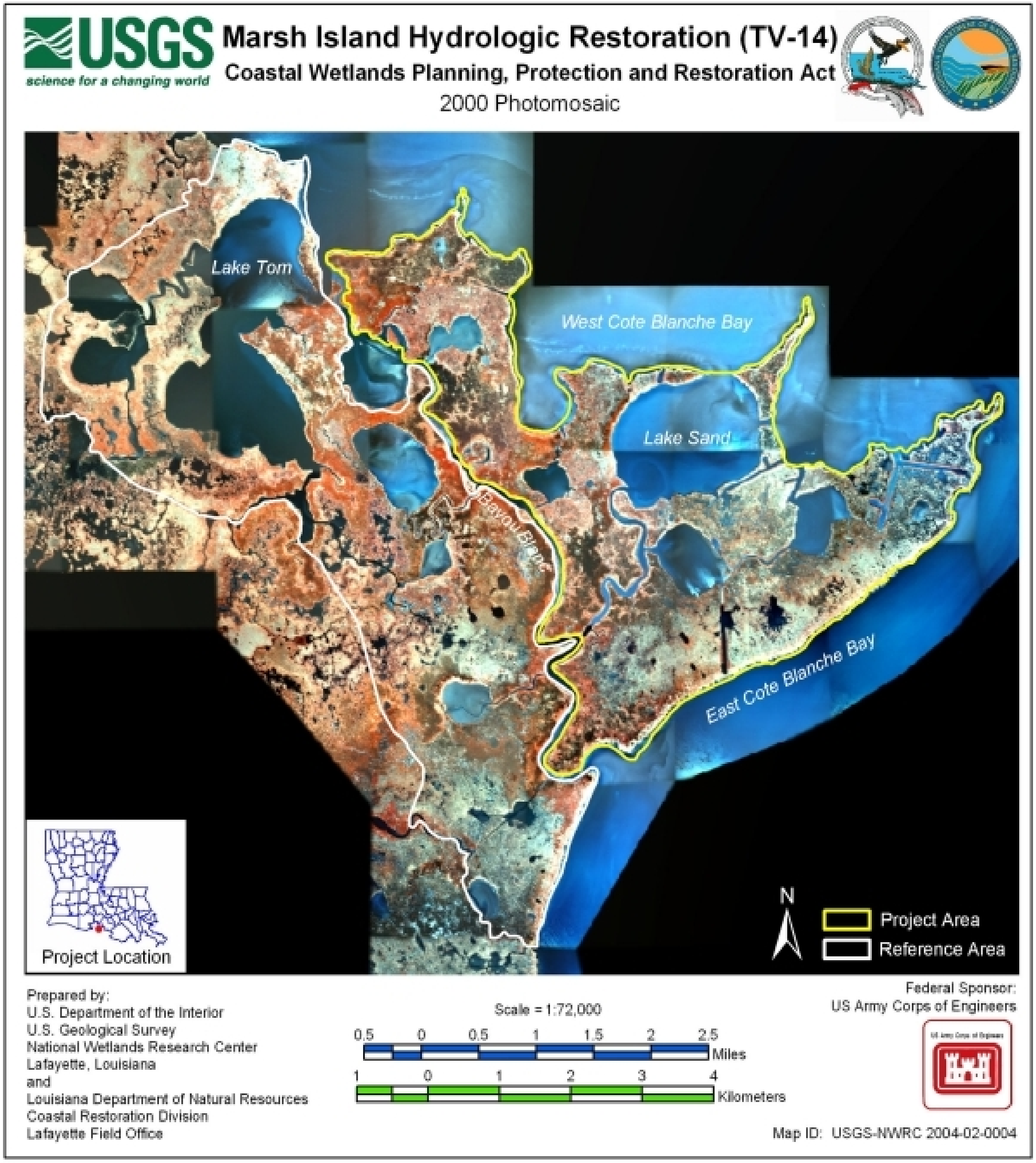

Figure 2. Photomosaic of the 2000 color-infrared aerial photography for the TV-14 project and reference areas from aerial photography taken November 27, 2000.

known datum, the North American Vertical Datum of 1988 (NAVD88). Continuous data recorders were installed in October 1999 and will document hourly water level data until December 2006, a period of five years following project construction. However, due to storm damage from Hurricane Lili on October 3, 2002, datum information for all water level stations were lost. Thus, no water level data since that date are relative to the NAVD88 elevational datum.

Figure 3. Aerial view of the northeastern shore of the TV-14 project (October 1999).

Figure 4. Shoreline configuration of the eastern shore of the TV-14 project (October 2001).

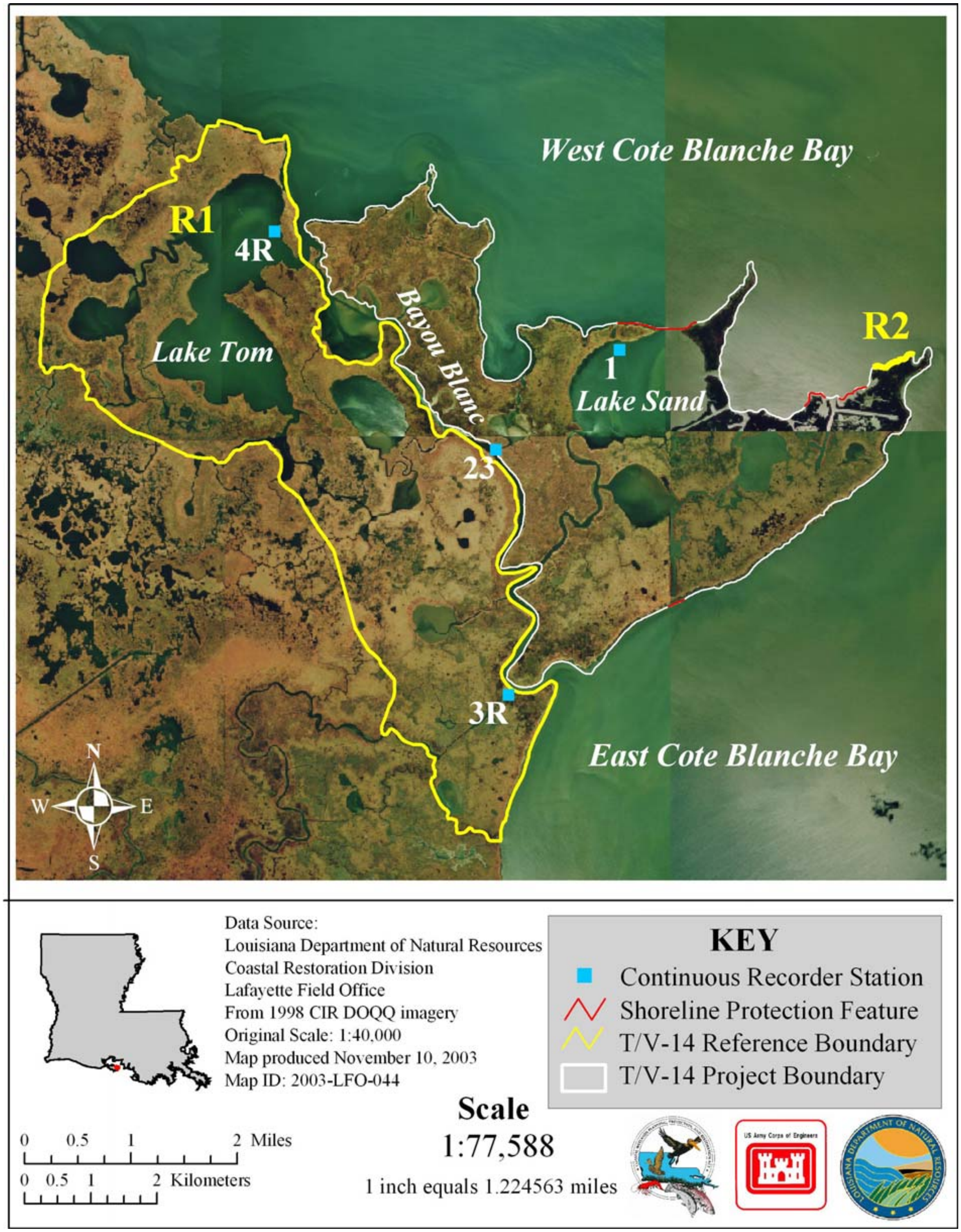

Figure 5. Hydrographic monitoring stations for the TV-14 project.

IV. Monitoring Activity (continued)

Submerged Aquatic Vegetation (SAV):

SAV was monitored using the rake method in the fall preceding construction in 1999 and in post-construction year 2002, and will be surveyed in 2004, 2006, 2009, 2011, 2013, and 2016. Restoration of the Lake Sand shoreline is expected to influence SAV primarily in Lake Sand, while canal plugs and spoil bank repair work is expected to influence SAV primarily in other shallow open water areas. Separate tests were therefore used to evaluate SAV in Lake Sand and SAV in shallow open water areas. The frequency of occurrence of SAV in Lake Sand was compared to the frequency of occurrence of SAV in Lake Tom found in R1. Three parallel transects were established and separated by a distance approximately equal to one-fourth the pond width (figure 6). Each transect is composed of a minimum of twenty-five equally spaced sampling stations. At each station, aquatic vegetation was sampled by dragging a garden rake on the pond bottom for one second. The presence of vegetation was recorded to determine the frequency of aquatic plant occurrence (frequency = number of occurrences/25 x 100). When vegetation was present, the species present were recorded in order to determine the frequencies of individual species. In shallow open water areas, three small ponds in the project area were compared to three small ponds in R1. Two parallel transects, separated by a distance approximately equal to one-third the pond width were established in each pond and investigated using similar sampling techniques as discussed above. Ancillary salinity data, collected with continuous data recorders and monthly discrete samples, will be evaluated in concert with the statistical analysis to aid in the interpretation of SAV data.

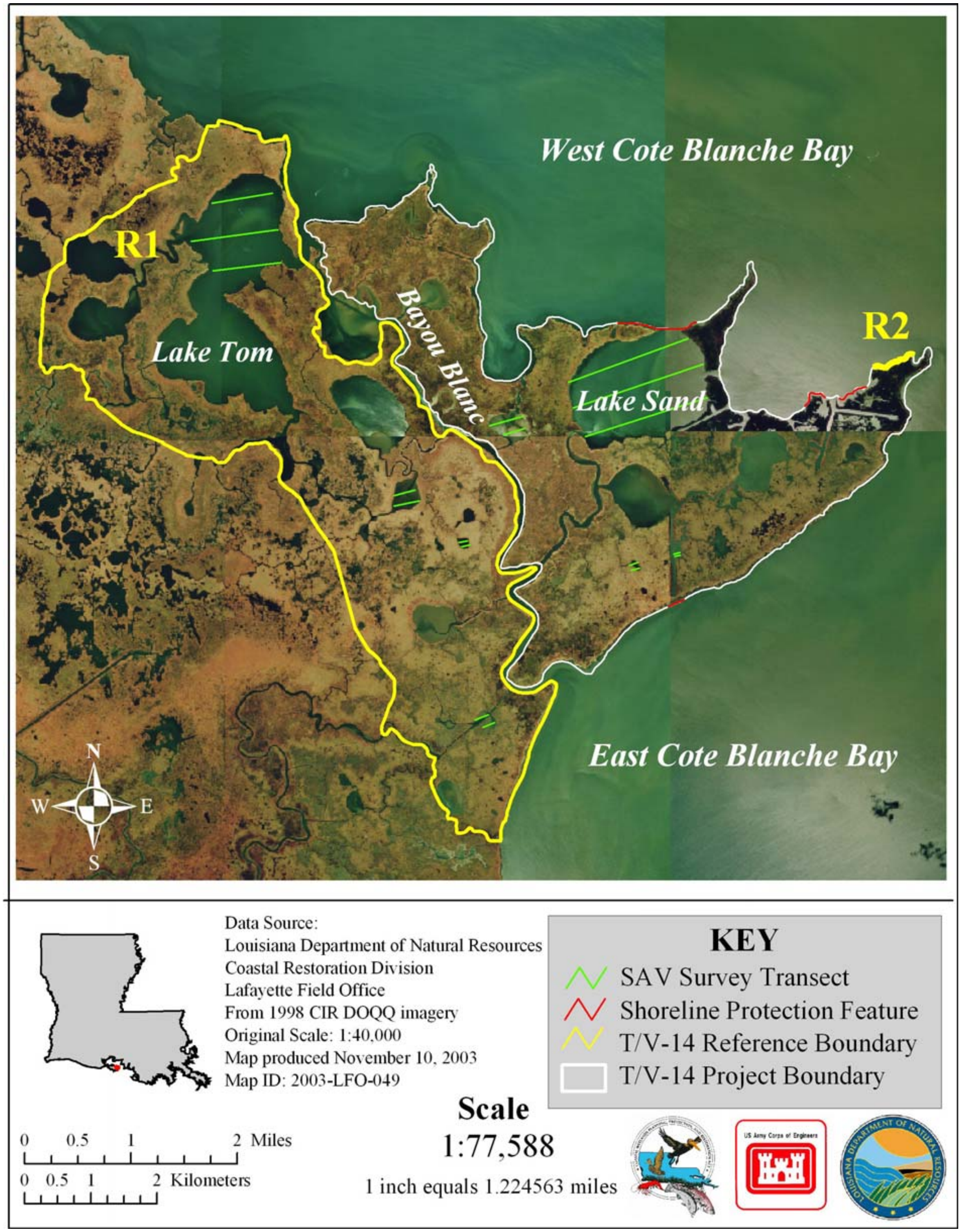

Figure 6. SAV monitoring survey transects for the TV-14 project and reference areas.

IV. Monitoring Activity (continued)

c. Preliminary Monitoring Results and Discussion

Aerial Photography:

Pre-construction classification (2000) indicated 69.8% land and 30.2% water within the project area and 64.4% land and 35.6% water within R1 (figure 7). The next scheduled aerial photography will be collected in November 2004.

Shoreline Position:

The 2003 data were processed and compared to the preconstruction dataset to determine changes in shoreline position and configuration (figure 8). GIS analysis of the shoreline datasets indicated a loss of 2.07 acres (0.84 ha) and a gain of 1.85 acres (0.75 ha) for a net loss of 0.22 acres (0.09 ha) in the project area between 1999 and 2003. In the reference area, a net loss of 0.05 (0.02 ha) acres was documented. However, since the preconstruction shoreline position was documented more than 3 years prior to project construction, this loss may not necessarily be attributable to project features. There is also some degree of error due to limitations in the GPS technology used for the surveys, as well as temporal variations in water level which may affect data accuracy. This amount of loss is not considered to be ecologically significant.

Water Level:

Hourly salinity and relative water level data for the 2 project and 2 reference stations for 2003 are presented in figures 9–12. Minimum, maximum, and mean water levels within the project area were all significantly lower ($P<0.0001$) than in R1 during the year (figures 13). Daily water level variability was significantly lower (0.17 ft [0.04 m]) within the project area than in R1 during 2003 (figure 14). As this decrease in water level variability was relatively small, the biological significance of this change could not be determined without more detailed vegetation sampling and analysis.

Station	Data collection period
TV14-01	10/12/1999 – present
TV14-02*	10/12/1999 – 3/14/2002
TV14-23	3/14/2002 – present
TV14-03R	10/12/1999 – present
TV14-04R	10/12/1999 – present

*The continuous recorder at TV14-02 was removed because of access problems following project construction. The replacement station, TV14-23 was installed closer to Bayou Blanc, a more accessible location.

Submerged Aquatic Vegetation (SAV):
Percent cover of SAV was significantly higher (13%) in R1 than the project area prior to construction in 1999. The common SAV species encountered during the preconstruction abundance survey are presented in table 1. The next scheduled SAV abundance survey will be collected in the fall of 2004.

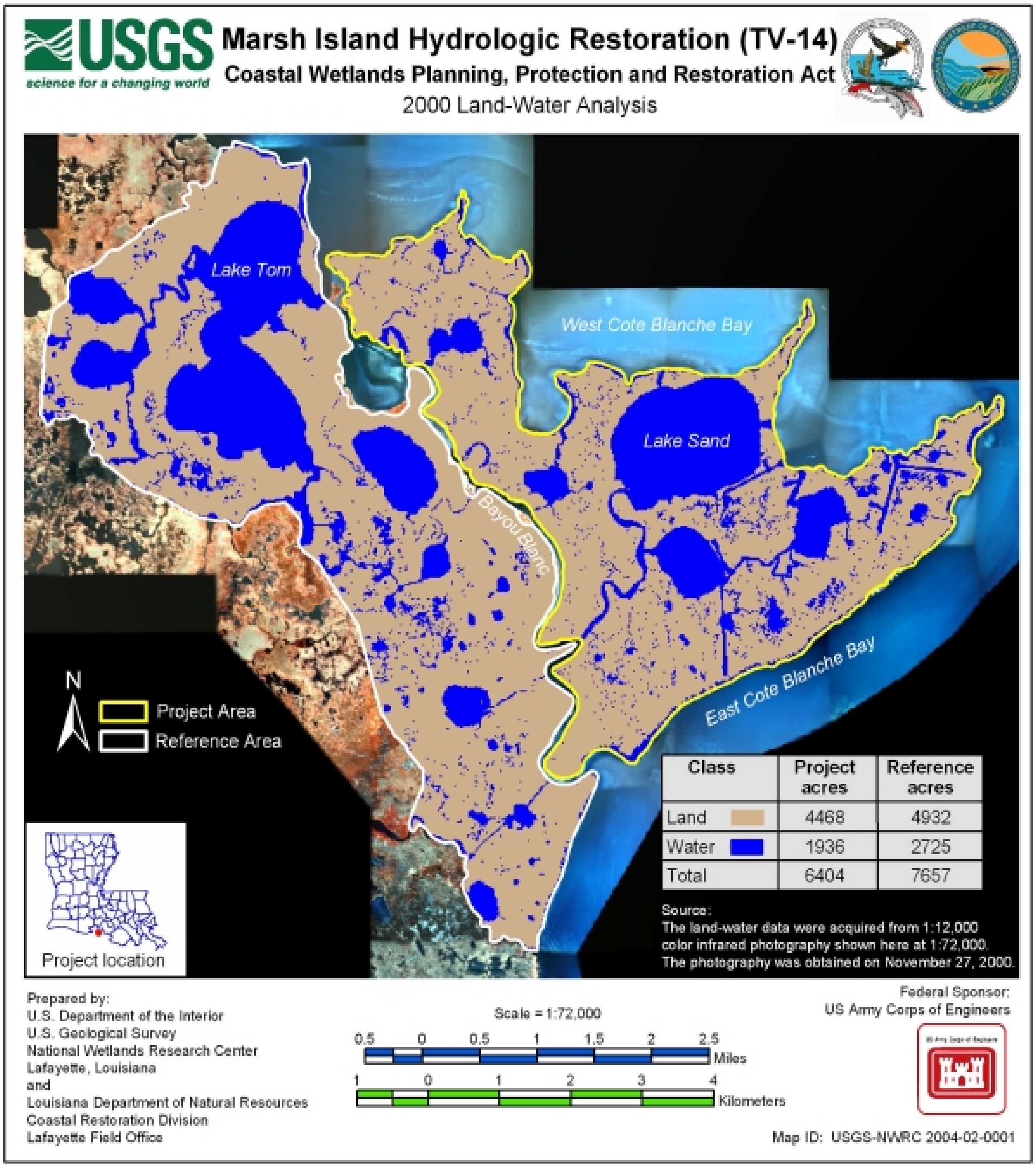

Figure 7. Results of the 2000 Land:Water GIS image classification for the TV-14 project and reference areas from aerial photography taken November 27, 2000.

-

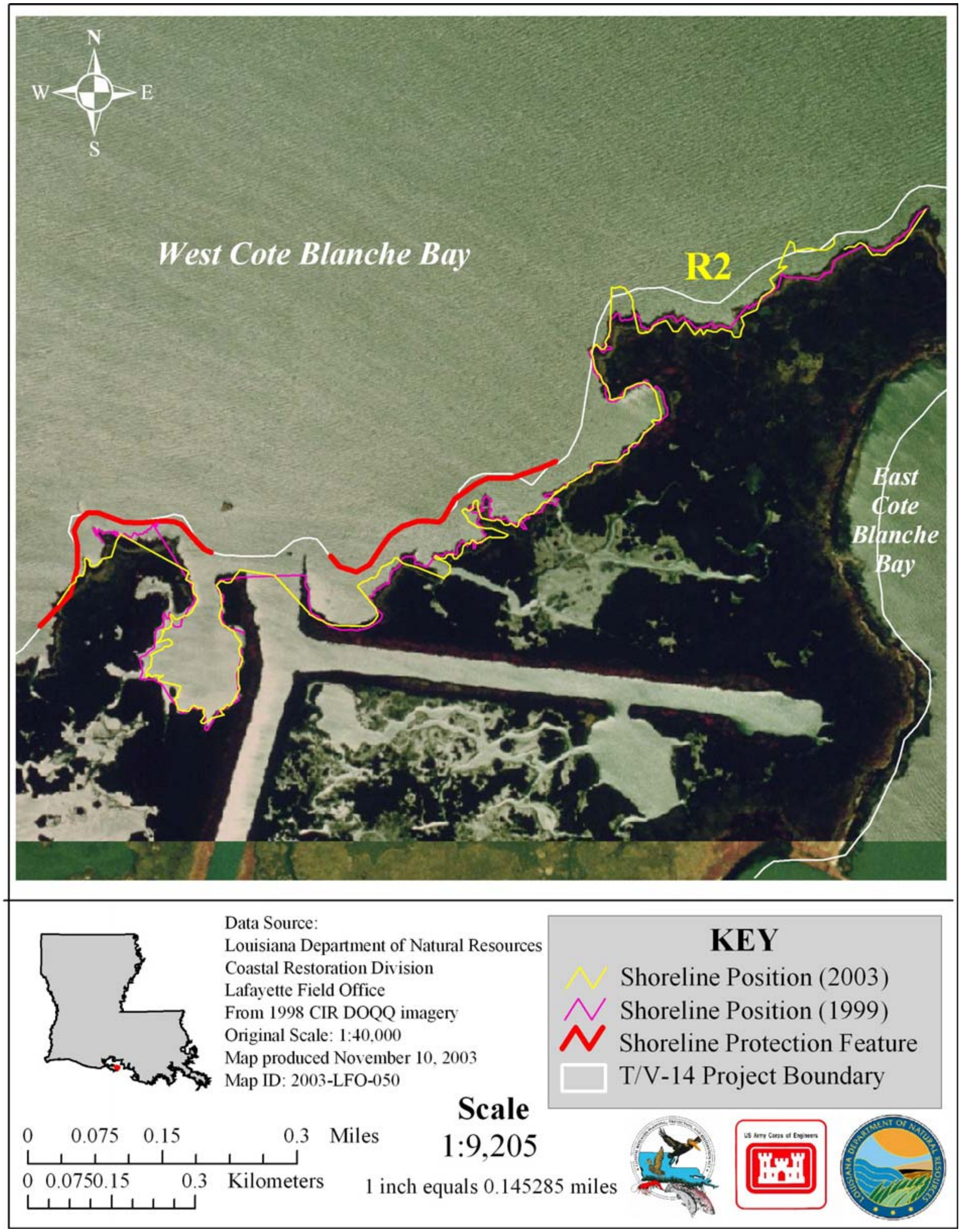

Figure 8. Comparison of shoreline position in 1999 and 2003 for the TV-14 project and reference areas.

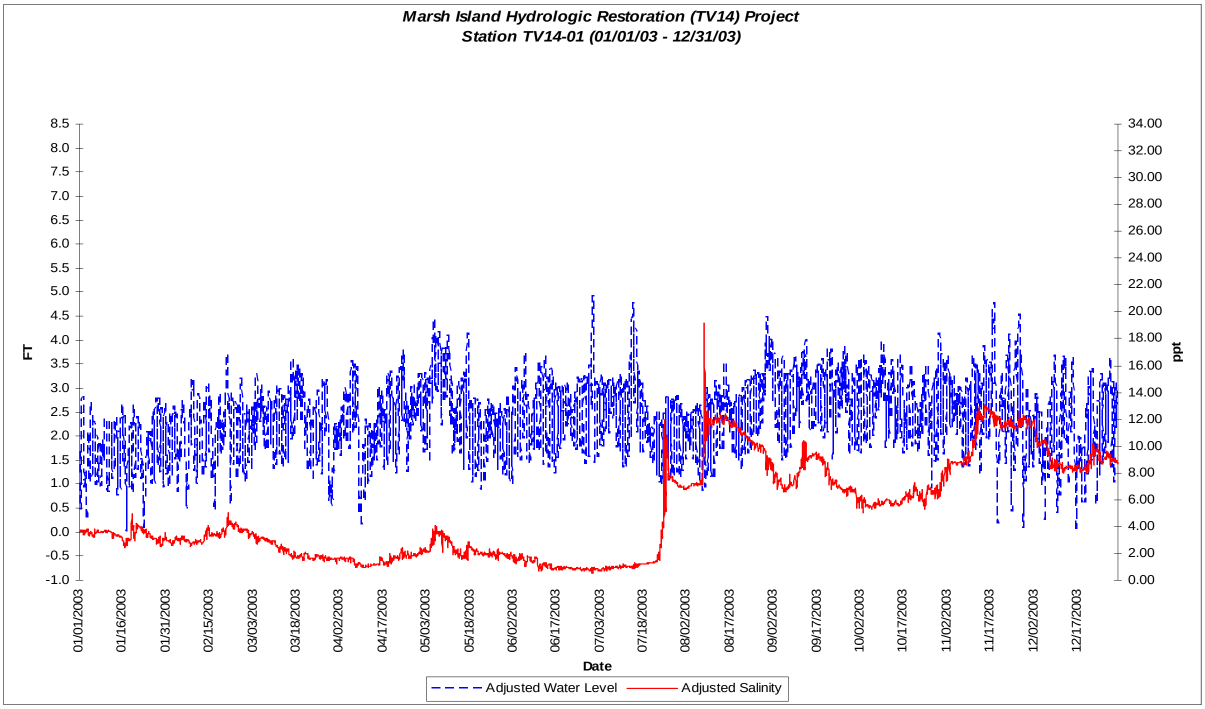

Figure 9. Salinity and relative water level data from 2003 for Station 1 in feet.

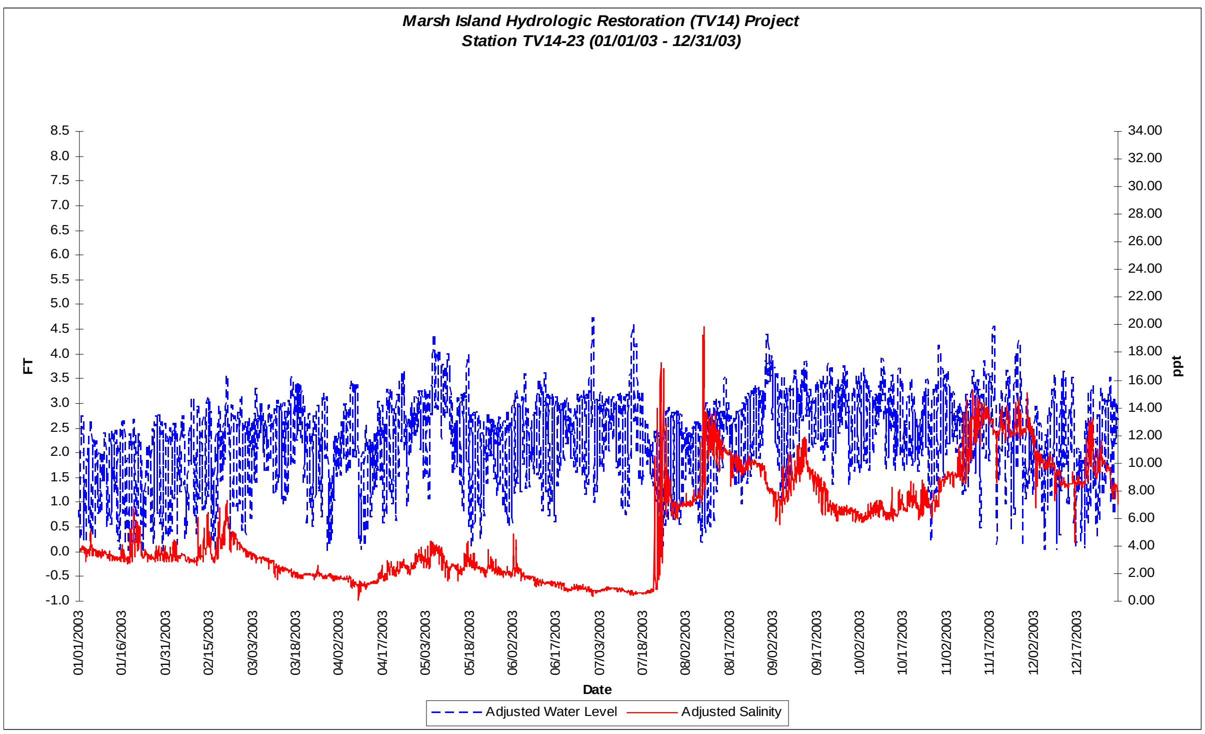

Figure 10. Salinity and relative water level data from 2003 for Station 23 in feet.

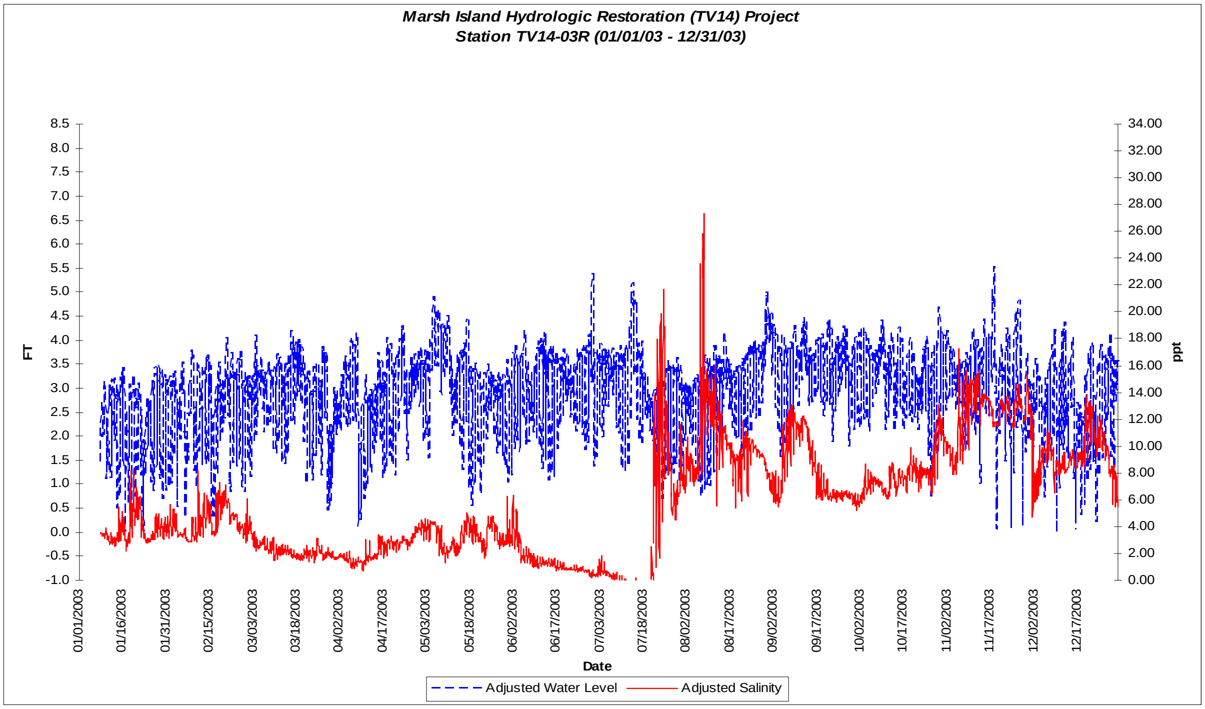

Figure 11. Salinity and relative water level data from 2003 for Station 3R in feet.

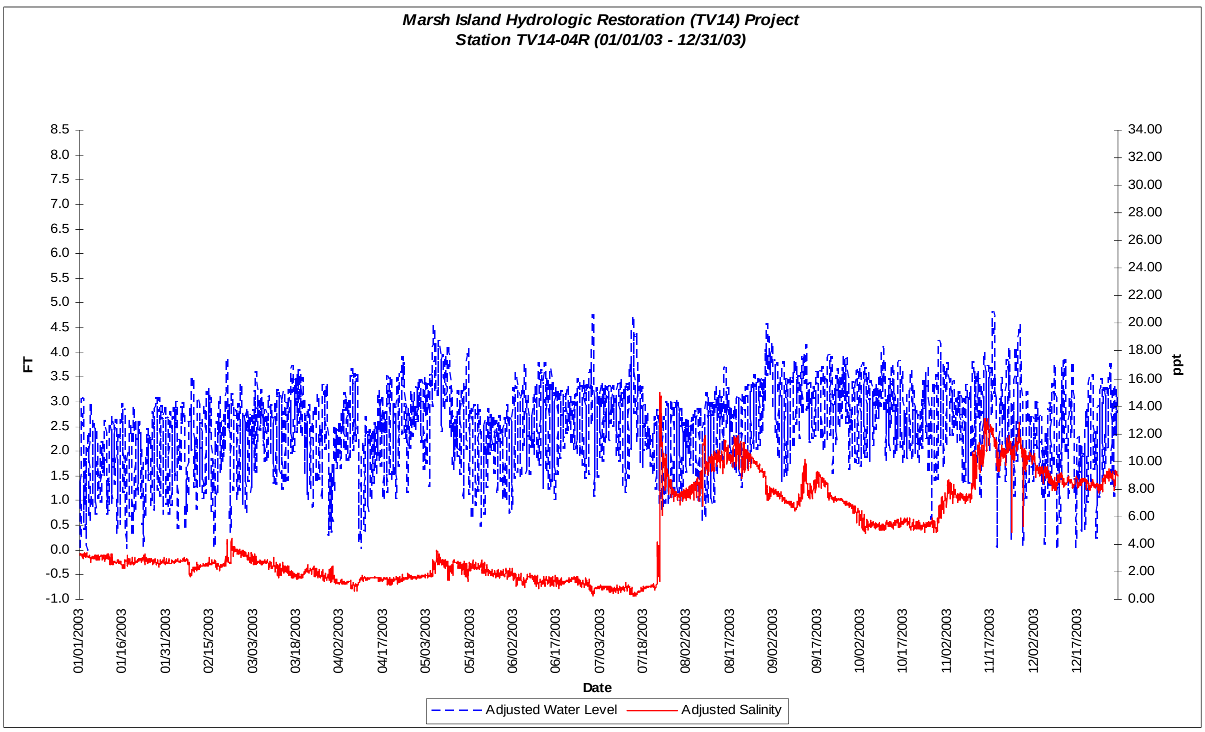

Figure 12. Salinity and relative water level data from 2003 for Station 4R in feet.

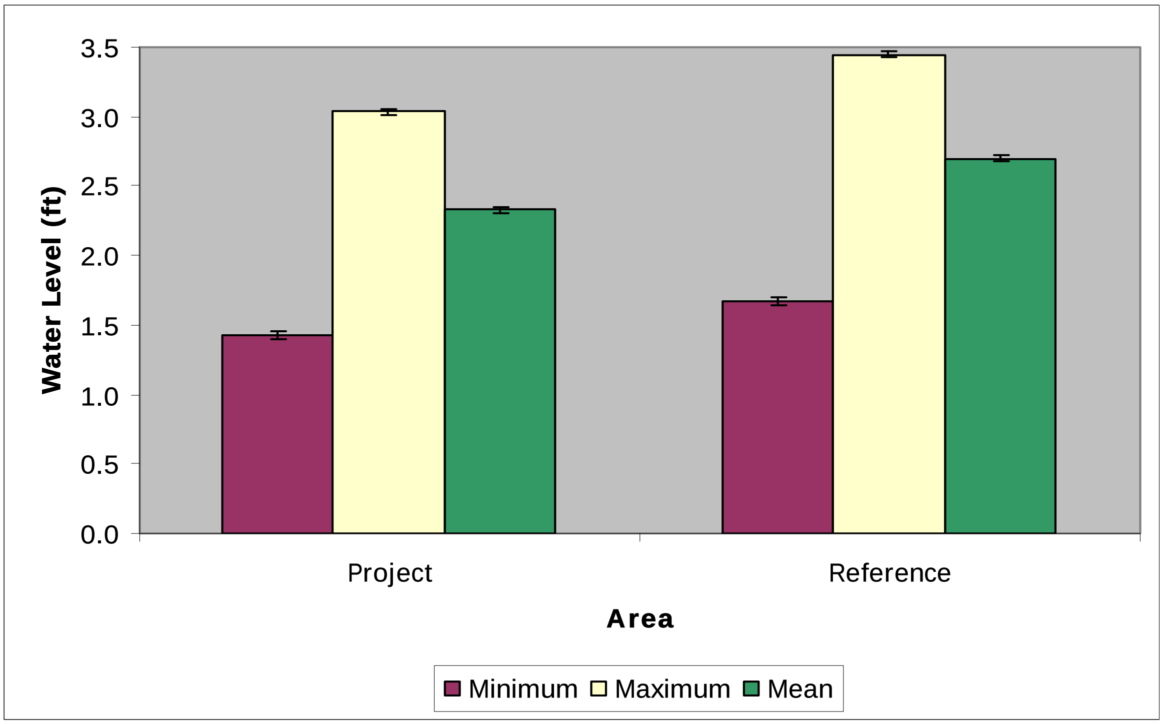

Figure 13. Minimum, maximum, and mean water level for project vs. reference areas in feet.

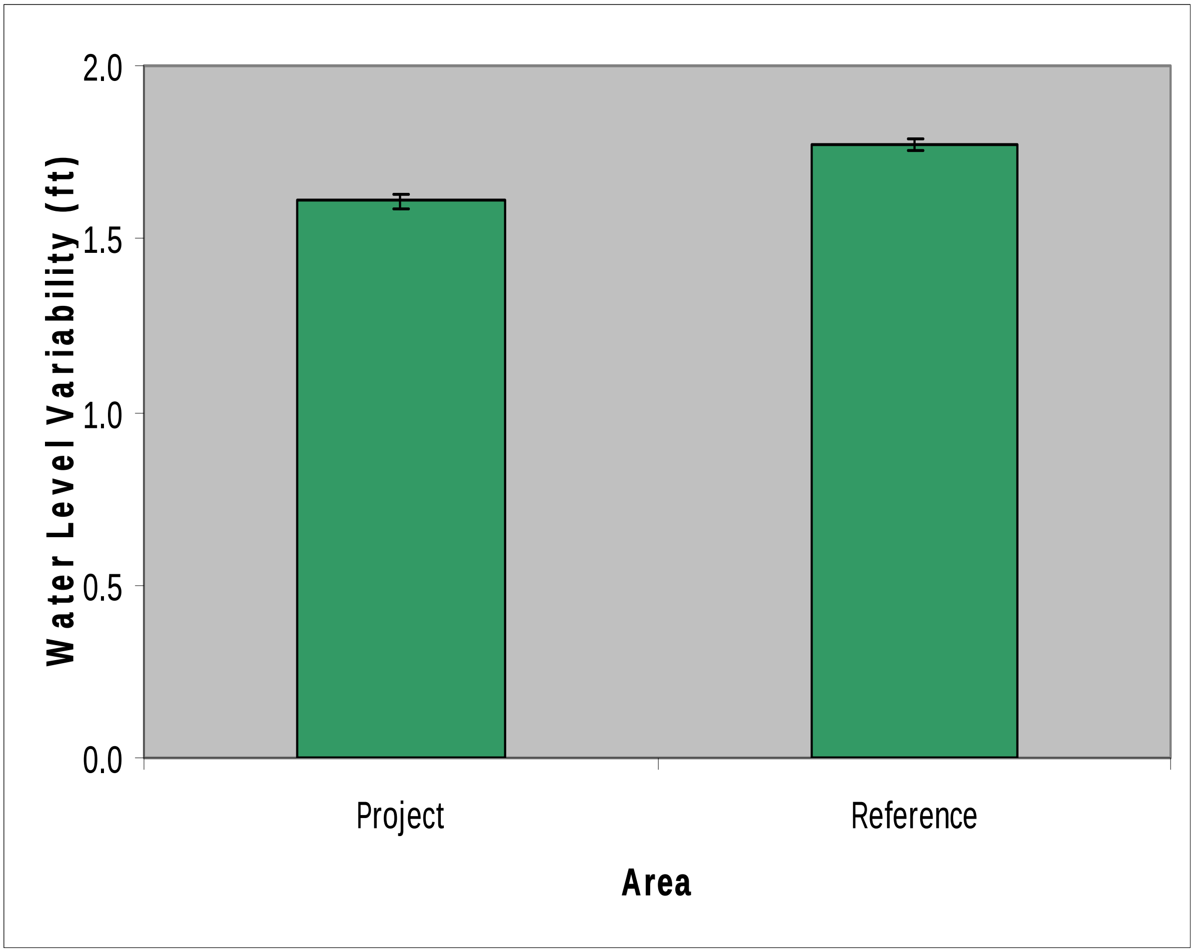

Figure 14. Water level variability for project vs. reference areas in feet.

Table 1. SAV species encountered during the abundance survey (preconstruction)-10/28/1999

Scientific Name	Common Name
Algae spp.	Alga
Cabomba caroliniana	Common Fanwort
Myriophyllum spicatum	Eurasian Watermilfoil
Ruppia maritima	Widgeon Grass

V. Conclusions

a. Project Effectiveness

The shoreline stabilization component of this project has resulted in a net change of -0.22 acres (-0.09 ha) within the project area, whereas the reference area decreased by -0.05 acres (0.02 ha). Some portions of the shoreline have eroded, while others prograded, and some portions experienced no change. At this time, the effectiveness of the shoreline protection component of the project is unclear. Additional scheduled shoreline position surveys should provide adequate information to make this determination in the near future.

Water level and water level variability were lower within the project area relative to the reference area. These results are consistent with water level variability since project construction. Prior to project construction, daily water level variability in the project and reference areas differed by only 0.07 ft (0.02 m). Following project construction, this difference increased threefold. The project thus far seems to be effective in reducing water level variability within the project area. Future analysis will provide information relative to the project's impacts on the sustainability of the vegetated wetlands on Marsh Island and the biological significance of this reduction in water level variability.

b. Recommended Improvements

Hurricane Lili damage imposed on the structure components of the project will be repaired in Spring 2005 through a FEMA funded construction contract.

c. Lessons Learned

The availability of an initial immediate post-construction location of as-built shoreline position survey in 2001 could have provided a better assessment of the effectiveness of the shoreline protection component of the project. Additionally, more timely elevation surveys to establish vertical locations of monitoring instruments and staff gauges following station damage would greatly improve the ability to assess project effectiveness much faster, allowing better management of project features.

The ends of all plugs, closures, or weir type structures that are constructed in or across canals or bayous should be constructed such that a blanket of 16 to 18 inches of Type 110# stone is placed over the adjacent marsh bank of the immediate area of the ends of the structure. The purpose of this bank paving is to make the adjacent bank or marsh area "hard" to resist the erosive effect of storm or abnormal high tidal flow when such events occur. Stone placed should be to areas of varying size or diameter, dependant on size of canal or bayou that will be conveying the flow, and stone should be dropped and tamped into the marsh or bank so as to not raise the elevation of the area. This lesson learned evolves from our experience at observing damage caused by high tide and storm events at ends of various structures described above. Basically stated, the erosion problem occurs when unusual high water flow, into or out of the marsh, develops at a structure. The wall or sides of the structure restrict the flow for a portion of the structure that is higher in elevation than adjacent marsh, such that the flow continues but is much higher in velocity at each end of the structure. This higher velocity flow then causes erosion at ends of the structure.